



# math for real

*"when will I ever use this?"*

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## Space and Time

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### SOLUTIONS

1. a.  $150 \text{ million km} \div 300,000 \text{ km/sec.}$   
 $= 500 \text{ sec.}$

b.  $500 \text{ sec.} \div 60 \text{ sec./min.} \approx 8 \text{ min., } 20 \text{ sec.}$

2. No, we do not know what is happening on the sun in real time. We only have 8-minute-old information about the sun.

3. a. Thirty-nine trillion, nine hundred billion

b.  $(2.55 \times 10^{17} \text{ km}) \div 300,000 \text{ km/sec.}$   
 $\approx 4.24 \text{ years, or } 133 \text{ million seconds.}$

4. There are

$(60 \text{ sec.} \times 60 \text{ min.} \times 24 \text{ hr.} \times 365 \text{ days})$

in a year, or 31,536,000 seconds in a year. At 300,000 km/sec., light can travel approximately  $9.46 \times 10^{12} \text{ km}$  in a year.

5. 27,000 (or  $2.7 \times 10^4$ ) light-years. The information is 27,000 years old.

6. About  $1.22 \times 10^{23} \text{ km}$

7. The information is about 12.9 billion years old. The information we are getting now comes from 12.9 billion years before us, or just 800 million years after the Big Bang. That light was emitted much closer to the Big Bang than to us and gives us information about the conditions of that quasar 12.9 billion years ago.